**Graphing Motion with a Motion Detector**

**Purpose**: to make qualitative interpretations of motions from graphs. **Name: \_\_\_\_\_\_\_\_\_\_\_\_\_**

**Equipment:**

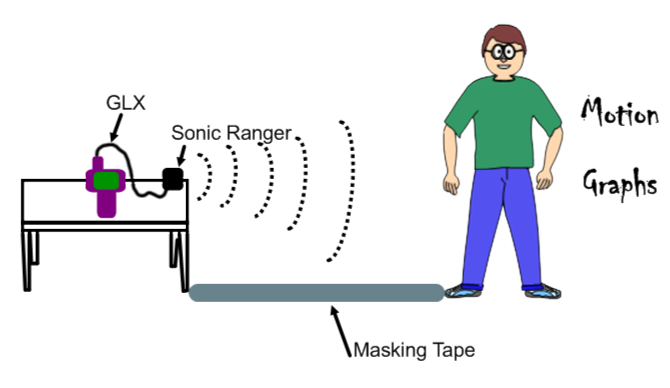
* Sonic ranger motion sensor
* Xplorer GLX interface/digital adaptor
* Masking Tape

**Discussion**: Have you ever wondered how bats can fly around in the dark without bumping into things?> A bat makes squeaks that reflect off walls and objects, then return to the bats head where they are processed by its brain to give clues as to the location of the nearby objects. The automatic focus on some cameras works on very much the same principle. The sonic ranger is a device that measures the time that ultra-high-frequency sound waves take to go to and return from a target object. The data are fed into a computer, where they are graphi8cally displayed on the monitor. Data plotting software can display the data in three ways: distance vs. time, velocity vs. time, and acceleration vs. time.

**Procedure:**

**Step 1**: your teacher will set up the sonic ranger and the GLX for you. Check to see that the sonic ranger appears to be functioning properly.

**Step 2**: Place the sonic ranger on the lab bench so that its beam chest high. Place 5 meters of masking tape on the floor in a straight line from the sonic ranger, as shown in figure A.



**Step 3:** Plug in the Xplorer GLX. Use arrows to select “motion sensor,” and click the check mark to select it. Adjust the sonic ranger software so that it displays a position vs. time plot. Point the sonic ranger at a student standing at the 5-meter mark of the tape. Calibrate the tape by marking where the computer registers 1m, 2m, and so on.

**Step 4**: Stand on the 1-meter mark. Always face the sonic ranger and watch the monitor. Back away from the sonic ranger slowly and observe the graph made. Repeat, backing away from the sonic ranger faster and observe the graph made.

1. How do the graphs compare? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Step 5**: Stand at the far end of the tape. Slowly approach the sonic ranger and observe the graph plotted. Repeat, walking faster, and observe the graph plotted.

1. How do the graphs compare? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Step 6**: Back away from the sonic ranger slowly; stop, then approach quickly. Sketch the shape of the resulting graph. Place time on the X-axis and distance on the y-axis.

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1. Describe what walking motions result in the graphs shown below.

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